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DOCUMENT-IDENTIFIER: JP **63016773** A

TITLE: CRT MONITORING DEVICE

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INVENTOR-INFORMATION:

NAME

UMENO, DAISUKE

ASSIGNEE-INFORMATION:

NAME	COUNTRY
MITSUBISHI ELECTRIC CORP	N/A

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INT-CL (IPC): H04N003/23

ABSTRACT:

PURPOSE: To lower the cost of a distortion correction circuit, and to miniaturize and make a device light weight, by providing an amplitude modulating transistor which changes the amplitude value of a horizontal deflection control signal, and a transistor control circuit which controls a control current to the above transistor, at the distortion correction circuit.

CONSTITUTION: A horizontal synchronizing pulse(H-SYNC) is frequency-divided in an appropriate resolution range at a frequency divider 26, and based on an obtained clock, a shifter 25 shifts an output signal to a decoder 24 in a sequence of a high-order bit, a low-order bit, and the high-order bit. The output signal from the shifter 25 is inputted to the decoder 24, and is coded,

and it is resulted that the quantities of distortion correction of eight levels per half shift are formed in the circuit. The above eight levels of the quantities of correction are added to the base of the amplitude modulating transistor 14 through variable resistors 18∼20, and a horizontal deflecting current which flows on a horizontal deflecting yoke 7 is modulated finally so as to have the maximum amplitude in the center of one vertical cycle, by the amplitude modulating transistor 13, and right and left bobbin winding shape distortion can be corrected.

⑲日本国特許庁（JP）　⑪特許出願公開
⑫公開特許公報（A）　昭63-16773

⑤Int.Cl.⁴　識別記号　庁内整理番号　㊸公開　昭和63年(1988)1月23日
H 04 N 3/23　A－6668－5C

審査請求　未請求　発明の数　1　（全5頁）

㉔発明の名称　ＣＲＴモニタ装置

㉑特　願　昭61－162501
㉒出　願　昭61(1986)7月8日

㉗発明者　梅野　大介　長崎県長崎市丸尾町6番14号　三菱電機株式会社長崎製作所内
㉑出願人　三菱電機株式会社　東京都千代田区丸の内2丁目2番3号
㉔代理人　弁理士　大岩　増雄　外2名

明　細　書

1.発明の名称

ＣＲＴモニタ装置

2.特許請求の範囲

荷電粒子線を水平偏向部材および垂直偏向部材を用いて二次元走査すべく上記の水平偏向部材および垂直偏向部材へそれぞれ水平偏向用制御信号および垂直偏向用制御信号を出力する荷電粒子線偏向用制御回路をそなえたＣＲＴモニタ装置において、そのモニタ画面での表示の歪みを補正すべく、上記制御回路に、上記水平偏向用制御信号を垂直偏向用制御信号情報で振幅変調する歪み補正回路が設けられて、同歪み補正回路が、上記水平偏向用制御信号の振幅値を変化させるべく上記水平偏向部材に接続された振幅変調用トランジスタと、同トランジスタへの制御電流を制御するトランジスタ制御回路とを含んで構成されたことを特徴とするＣＲＴモニタ装置。

3.発明の詳細な説明

〔産業上の利用分野〕

この発明は、ビデオおよび同期信号を入力とし、偏向ヨーク（水平偏向部材および垂直偏向部材）にてブラウン管の荷電粒子線を二次元走査するＣＲＴモニタ装置に関し、特にそのモニタ画面上の左右糸巻き状歪みを補正するようにしたＣＲＴモニタ装置に関するものである。

〔従来の技術〕

一般に、ＣＲＴモニタ装置に用いられるモニタ画面としてのブラウン管では、その特質として偏向中心とシャドウマスクの曲率との違いから、映し出される画面が、左右糸巻き状に歪む（第3図参照）。このような画面垂直方向の歪みを補正すべく、従来、ＣＲＴモニタ装置の荷電粒子線水平偏向用制御回路には第4図に示すような歪み補正回路が付加されている。

すなわち、第4図は従来のＣＲＴモニタ装置における荷電粒子線水平偏向用制御回路および歪み補正回路を示す回路図（参考文献：特開昭56-58372「偏向回路」）であり、図において、1は荷電粒子線水平偏向用制御回路、2は水平出力トランジス

タ、3はダンパーダイオード、4は共振用コンデンサ(Cr)、5はフライバックトランス(FBT)、6は電源(+B)、7は水平偏向部材としての水平偏向ヨーク[Ldy(H)]、8はs字補正コンデンサ(Cs)、9は水平偏向ヨーク7とs字補正コンデンサ8との間に直列に設けられた歪み補正回路としてのサイドピン補正トランス(過飽和リアクトル)、10は垂直偏向部材としての垂直偏向ヨーク[Lyd(V)]、11はサイドピン補正トランス9と垂直偏向ヨーク10との間に介装されたカツプリングコンデンサ、12は垂直出力トランジスタ、Pは水平出力トランジスタ2に入力される水平発振パルスである。

ここで、荷電粒子線水平偏向用制御回路1は、水平出力トランジスタ2,ダンパーダイオード3,共振用コンデンサ4,フライバックトランス5,電源6,水平偏向ヨーク7およびs字補正コンデンサ8から構成される一方、荷電粒子線垂直偏向用制御回路が垂直偏向ヨーク10および垂直出力トランジスタ12から構成されており、これらの荷電粒子線水平偏向用制御回路1および荷電粒子線垂直偏向用制御回路により、それぞれ水平偏向ヨーク7および垂直偏向ヨーク10を流れる電流が制御され、荷電粒子線が二次元走査されるようになつている。

次に動作について説明する。その動作原理は、水平偏向電流の包絡線を、垂直発振パルスに同期させて放物線状に振幅変調する。

つまり、左右糸巻き状歪みは、画面中央部で水平振幅が不足していると考えられるので、水平偏向ヨーク7に流れる電流に振幅不足分の補正電流を重畳して補正するのである。

上述の従来のCRTモニタ装置では、サイドピン補正トランス9が水平偏向ヨーク7に直列に接続されており、このサイドピン補正トランス9により、水平偏向ヨーク7を流れる電流が、荷電粒子線垂直偏向用制御回路における垂直発振パルスに同期した放物線状電流で変調されて、上記左右糸巻き状歪みが補正されるのである。

[発明が解決しようとする問題点]

しかしながら、従来のCRTモニタ装置における歪み補正回路では、サイドピン補正トランス9を用いており、左右糸巻き状歪みの補正量を変更する際には、サイドピン補正トランス9の巻線を巻き加えたり巻き戻したりしなくてはならず、コストやスペース的に不利であるなどの問題点があつた。

この発明は上記のような問題点を解消するためになされたもので、サイドピン補正トランスを用いることなく、容易かつ安価に歪みを補正できるようにするとともに、その補正量の変更を容易に行なえるようにした、CRTモニタ装置を得ることを目的とする。

[問題点を解決するための手段]

この発明に係るCRTモニタ装置は、水平偏向部材および垂直偏向部材へそれぞれ水平偏向用制御信号および垂直偏向用制御信号を出力する荷電粒子線偏向用制御回路に、水平偏向用制御信号を垂直偏向用制御信号情報で振幅変調する歪み補正回路を設けて、同歪み補正回路を、上記水平偏向用制御信号の振幅値を変化させるべく上記水平偏向部材に接続された振幅変調用トランジスタと、同トランジスタへの制御電流を制御するトランジスタ制御回路とを含んで構成したものである。

[作　　用]

この発明におけるCRTモニタ装置では、振幅変調用トランジスタにより、水平偏向用制御信号の振幅値が変調される。また、上記振幅変調用トランジスタへの制御電流は、トランジスタ制御回路により、垂直偏向用制御信号情報に基づいて制御される。

[発明の実施例]

以下、この発明の一実施例を図について説明する。第1図は本発明の一実施例としてのCRTモニタ装置における荷電粒子線水平偏向用制御回路および歪み補正回路を示す回路図であり、この第1図において、符号2～8はいずれも従来と同様の荷電粒子線水平偏向用制御回路1を構成するもので、その説明は省略する。また、第1図においては、垂直偏向部材(第4図の符号10参照)等の

図示は省略されている。

13，14はいずれも水平偏向用制御信号としての水平偏向電流を制御する振幅変調用トランジスタであり、これらのトランジスタ13，14は、従来のサイドピン補正トランス9に代わり、水平偏向ヨーク7に接続されている。

また、15,16はトランジスタ13,14用の抵抗、17はトランジスタ13,14の電源(+B)、18,19,20は歪み補正量を段階的に制御するための可変抵抗、21,22,23はそれぞれ可変抵抗18,19,20に接続されるインバータ(オープンコレクタ)、24はインバータ21,22,23を介し可変抵抗18,19,20を制御するための信号を出力するデコーダ、25はシフター、26は垂直偏向用制御信号情報としての垂直同期パルス(V-SYNC)を受けて水平同期パルス(H-SYNC)を分周する分周器である。

ここで、シフター25は、分周器26により適当に分周された信号に基づき、垂直同期パルス(V-SYNC)の一周期間、デコーダ24への出力信号を一巡シフトさせるものである。

また、デコーダ24は、シフター25からの信号をデコードして、可変抵抗18,19,20を制御し一巡する間にトランジスタ13，14のベース電流を段階的に変化させるものである。

なお、27はトランジスタ制御回路、28は歪み補正回路であり、トランジスタ制御回路27は、可変抵抗18,19,20，デコーダ24，シフター25，分周器26等から構成され、歪み補正回路28は、振幅変調用トランジスタ13，14およびトランジスタ制御回路27から構成されている。

次に動作について説明する。その動作原理は、従来と同様に、水平偏向電流の包絡線を、垂直発振パルスと同期させて放物線状に振幅変調する。

CRTモニタ装置に用いられるモニタ画面としてのブラウン管では、その特質として偏向中心とシヤドウマスクの曲率との違いにより、映し出される画面は、第3図の実線で示すように左右糸巻き状に歪む(左右それぞれの中央部における最大歪み量をΔHで示す)。

このような画面垂直方向の歪みを補正すべく、本実施例では、垂直偏向用制御信号情報として垂直同期パルス(V-SYNC)を用いて、水平方向の偏向用制御信号としての水平偏向電流を次のようにして変調する。

つまり、水平同期パルス(H-SYNC)は分周器26において適当な分解能の範囲で分周され、この分周によつて得られたクロックに基づき、シフター25は、上位ビット⇒下位ビット⇒上位ビットの順でデコーダ24への出力信号をシフトする。

一方、垂直同期パルス(V-SYNC)は、シフター25からの出力信号を1往復させるためのトリガ信号として用いられる。

このシフター25からの出力信号は、デコーダ24へ入力され、コード化(3ビット)される。この回路では、片シフト当たり、8レベルの歪み補正量が形成されることになる。

この8レベルの補正量が可変抵抗18，19，20を介し振幅変調用トランジスタ14のベースに加えられ、最終的に、振幅変調用トランジスタ13により、水平偏向ヨーク7を流れる水平偏向電流が、第2図に示すごとく、垂直1周期の中央で最大振幅(2×ΔHに対応)となるように変調され、第3図に示すような左右糸巻き状歪みが補正されるのである。

このように、本実施例によれば、従来のようなサイドピン補正トランス（第4図の符号9参照）を用いることなく、左右糸巻き状歪みが補正されるようになるとともに、補正量の変更は、抵抗値(抵抗15，16あるいは可変抵抗18，19，20)の変更により容易に行なわれるため、歪み補正回路が安価になるほか小型・軽量化される利点がある。

なお、上記実施例のトランジスタ制御回路における可変抵抗18，19，20およびインバータ21,22,23をD／A(デイジタル／アナログ)変換器に置き換えてもよく、この場合、上記実施例と同様の効果を奏するほか、回路構成をさらに簡略化できるとともに連続的な歪み補正を行なえ

るようになる効果も得られる。

［発明の効果］

以上のように、この発明によれば、水平偏向部材および垂直偏向部材へそれぞれ水平偏向用制御信号および垂直偏向用制御信号を出力する荷電粒子線偏向用制御回路に、水平偏向用制御信号を垂直偏向用制御信号情報で振幅変調する歪み補正回路を設けて、同歪み補正回路を、上記水平偏向用制御信号の振幅値を変化させるべく上記水平偏向部材に接続された振幅変調用トランジスタと、同トランジスタへの制御電流を制御するトランジスタ制御回路とを含んで構成したので、サイドピン補正トランスを用いることなく、モニタ画面上の左右糸巻き状歪みが容易に補正されるようになり、その歪み補正回路が安価にでき小型・軽量に構成される効果がある。

4.図面の簡単な説明

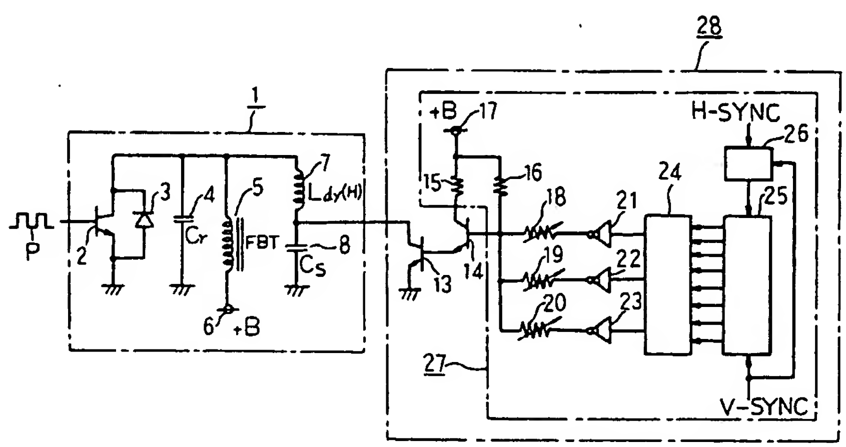
第1図は本発明の一実施例としてのCRTモニタ装置における荷電粒子線水平偏向用制御回路および歪み補正回路を示す回路図であり、第2図は本装置における水平偏向電流の変調状態を示すグラフ、第3図は一般的な左右糸巻き状歪みを示す模式図であり、第4図は従来のCRTモニタ装置における荷電粒子線水平偏向用制御回路および歪み補正回路を示す回路図である。

図において、1—荷電粒子線水平偏向用制御回路、7—水平偏向部材としての水平偏向ヨーク、10—垂直偏向部材としての垂直偏向ヨーク、13,14—振幅変調用トランジスタ、27—トランジスタ制御回路、28—歪み補正回路。

なお、図中、同一の符号は同一、又は相当部分を示している。

代理人　大岩増雄

第1図



1……荷電粒子線水平偏向用制御回路

7……水平偏向ヨーク

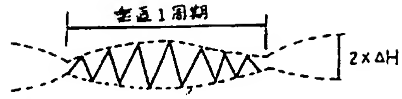
10……垂直偏向ヨーク

13，14……振幅変調用トランジスタ

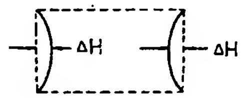
27……トランジスタ制御回路

28……歪み補正回路

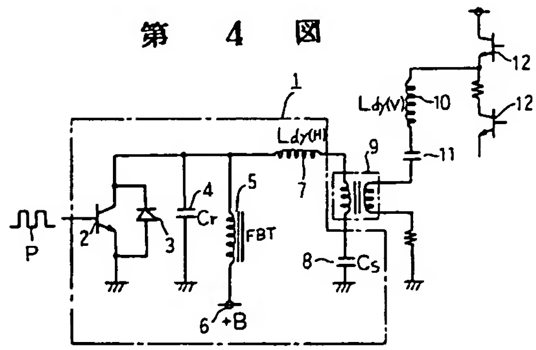
第 2 図



第 3 図



第 4 図



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(71) Applicant: SHARP KABUSHIKI KAISHA
Osaka 545 (JP)

(72) Inventors:
- Sato, Seiji
Toride-shi, Ibaragi (JP)
- Ema, Nobuyuki
Nagareyama-shi, Chiba (JP)
- Hibi, Keiichi
Matsudo-shi, Chiba (JP)

(74) Representative: Brown, Kenneth Richard et al
R.G.C. Jenkins & Co.
26 Caxton Street
London SW1H 0RJ (GB)

(54) Hierarchial video encoder and decoder

(57) In conducting video-communications by using a transmission line having a low transmission rate, there arise a considerable transmission delay because decoding can not begin until coded information for one frame arrives. The reduction of time-resolution of the decoded video due to thinning a sequence of video-frames is also a problem to be solved. A video-coding device divides a predicted-error signal into bands by band-dividing means (42), encodes each band and successively transmits the coded information for each frame in the order from a low frequency component by hierarchical coded-information transmitting means (43 to 49, 57). A video-decoding device (72 to 78) successively decodes and outputs the received coded information in the order from low-resolution. The video-decoding device successively decodes decoded information of successively arriving higher-frequency components and adds each component value to a preceding band value, enabling the use of the calculation results as frames interpolating omitted frames.

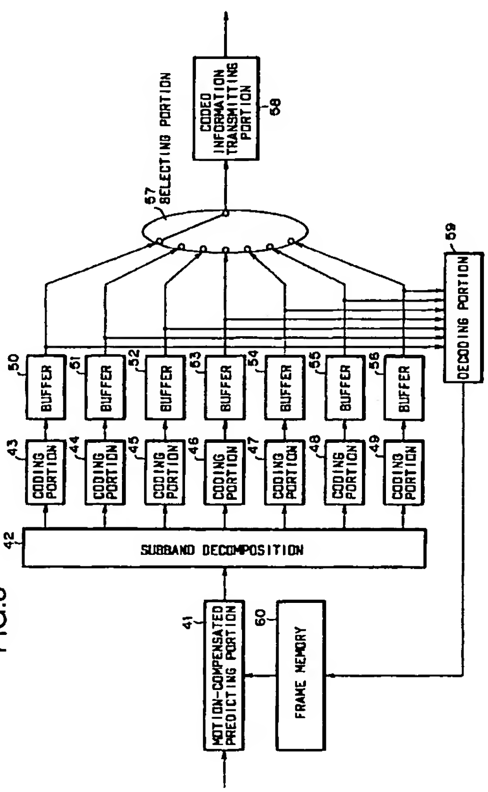

FIG.3

EP 0 762 773 A2

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Description

BACKGROUND OF THE INVENTION

The present invention relates to video-coding device for compressive encoding of video-signals by reducing redundancy contained therein so that the coded video-signal may be transmitted over communication channels and relates to a video-decoding device for decoding the video-signals coded by the video-coding device.

Recently, with the spread of digital transmission networks, the progress of video-data processing techniques and the advance of image compressing techniques, there has been an increasing need for realization of video communication services over communication networks.

Video communication services, which are represented by, e.g., television videophone services and video conferencing services, are now in the way of realization by means of high-performance communication networks such as ISDN (Integrated Service Digital Network) and B-ISDN (Broad Integrated Service Digital Network). Today, the above-mentioned video-communication services are also desired to be available over low-speed transmission networks such as analog telecommunication networks and mobile-communication networks. Many studies have been carried out for realizing these projects.

It is impractical to transmit video-signals as they are over any communication line because video-signals contains a large amount of data and requires a wide-band transmission capacity for transmission. However, each video-signal also includes redundancy and may be reduced by saving its redundancy. A compressive coding technique (hereinafter referred simply to as coding) is widely used to effectively handle and transmit video-signals.

As for a conventional video-coding device using an interframe-prediction with orthogonal transform coding method, an input video-signal is encoded frame by frame by a motion-compensated interframe-predicting portion. Namely, the. motion-compensated interframe-predicting portion reads, from a frame memory, a just-before encoded and stored therein video-frame as a predictive value, determines a difference of the input video-frame from the predictive value by using a differential computing portion and then encodes the obtained differential value by intraframe coding method.

The predicted error signal outputted from the differential computing portion is transferred to a discrete cosine-transformation portion (hereinafter referred to as DCT portion) wherein the signal is converted to a DCT coefficient by the method of DCT being a variety of orthogonal transformation.

The DCT coefficient value outputted from the DCT portion is transferred to a quantizing portion whereby it is quantized to a suitable level according to the quantizing step size specified by a coding control portion, thereby the information amount is compressed.

The quantized output from the quantizing portion is outputted as a coding result and is also transferred to an inverse quantizing portion.

The inverse quantizing portion obtains a DCT coefficient by performing the operations reverse to those made by the quantizing portion. The inverse DCT portion performs operations for inverse DCT on the obtained DCT coefficient.

The output signal of the inverse DCT portion is transferred to an adder portion whereby it is added to the predicted value read from the frame memory. The sum value is stored in the frame memory portion and will be used for interframe prediction for a proceeding input video-frame.

The input video-signal is thus encoded using a loop-like (coding loop) circuit.

The operation of the conventional hierarchical video-coding device is as follows:

The hierarchy organizing portion hierarchically classifies components of an input video-signal. The coding portions encode corresponding hierarchically classified components of the input video-signal by referring preceding coded and decoded components stored in the frame memory portions and output the coding results of the hierarchical components to an external device. On the other hand, the coding results from the coding portions are also transferred to the decoding portions whereby they are decoded and then transferred to the frame memory portions. The coding results stored in the frame memory portions will be used for coding a proceeding input video-signal.

As described above, the conventional video-coding device can considerably reduce the information amount of an input video-signal since it quantizes the video-signal after removing its temporal-redundancy by motion-compensated prediction and spatial redundancy by DCT. The coded video-signal with thus reduced information amount, however, is still inadaptable to be transmitted over a communication line featured by a low-transmission rate. Consequently, a sequence of frames to be transmitted is usually thinned by dropping all frames other than selected. This enables increasing the number of bits to be allocated to one frame, thereby improving quality of the coded video-signal.

The above-mentioned conventional video-coding device and video-decoding device, however, can not start decoding a video-frame until coded information of one frame is completely received. Therefore, a considerable delay of transmission may arise with dropping many frames when the devices work on a communication line having a low-transmission rate. The thinned sequence of frames may also decrease temporal-resolution of coded and decoded video-signals.

SUMMARY OF THE INVENTION

In view of the above-mentioned problems, it is an object of the present invention to provide a video-coding device and a video-decoding device, which are capable of coding and decoding video-signals to be transmitted, with a minimized transmission delay and a minimized decrease of temporal-resolution, over communication lines having a low-transmission-rate.

It is another object of the present invention to provide a video coding device which comprises subband decomposition means for decomposing a video-frame into subbands and hierarchical information-transmitting means for separately encoding video-information of each subband received from the subband decomposition means and successively transmitting the coded video-signal of at every resolution in each frame.

It is another object of the present invention to provide a video decoding device for decoding and displaying receiving coded video-signal of subbands for respective resolution ranges, which has hierarchical video-decoding means that decodes coded video-signal of subbands for every resolution in the order from low to high resolution and displays the decoded video-signal, then adds a sequence of transmitted images of high-resolution components to the corresponding images of low-resolution and displays complete video-frames.

It is another object of the present invention to provide a video-coding device which divides an input video-signal into subband components (frequency classes) by the subband-decomposition means, encodes subband-components respectively by the hierarchical coding means and successively transmits coded information of each resolution band in each frame by the hierarchical information-transmitting means.

It is another object of the present invention to provide a video-decoding device in which the hierarchical video-decoding means decode subband-components successively transmitted by the hierarchical information-transmitting means (of the video-coding device), starting from the lowest frequency (resolution) subband-components, namely, the video-decoding device can start decoding video-information at the time of receiving a low-frequency component signal for one frame without waiting for all hierarchical information of one frame (i.e., considerably reducing the transmission delay that the prior art device encountered).

It is another object of the present invention to provide a video-decoding device which displays first a low-frequency component video-frame and then a video-frame composed of the low-frequency component and higher resolution components, namely, the dropped frames are reproduced with interpolation by successively adding higher components to the preceding frame at the video-decoding side.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows the structure of a conventional video-coding device.

Fig. 2 shows the structure of a conventional hierarchical video-coding device.

Fig. 3 is a view showing an embodiment of a video-coding device according to the present invention.

Fig. 4 is a view how to subdivide a band by a subband-decomposition portion of a video-coding device according to the present invention.

Fig. 5 is a flow chart for explaining the operation of a video-coding device according to the present invention.

Fig. 6 is a view showing how to transmit coded information according to the present invention.

Fig. 7 is a view showing an embodiment of a video-decoding device according to the present invention.

Fig. 8 is a flow chart for explaining the operation of a video-decoding device according to the present invention.

Fig. 9 is a view for explaining a method for scaling a motion vector.

Fig. 10 illustrates video-images decoded by a conventional video-decoding device and by a video-decoding device according to the present invention.

PREFERRED EMBODIMENT OF THE INVENTION

Fig. 1 shows a conventional video-coding device using an interframe-prediction with orthogonal transform coding method. As shown in Fig. 1, an input video-signal is encoded frame by frame by a motion-compensated interframe-predicting portion 1. Namely, the motion- compensated interframe-predicting portion 1 reads, from a frame memory 2, a just-before encoded and stored therein video-frame as a predictive value, determines a difference of the input video-frame from the predictive value by using a differential computing portion 3 and then encodes the obtained differential value by intraframe coding method.

The predicted error signal outputted from the differential computing portion 3 is transferred to a discrete cosine-transformation (DCT) portion 4 wherein the signal is converted to a DCT coefficient by the method of DCT being a variety of orthogonal transformation.

The DCT coefficient value outputted from the DCT portion 4 is transferred to a quantizing portion 5 whereby it is quantized to a suitable level according to the quantizing step size specified by a coding control portion 6, thereby the information amount is compressed.

The quantized output from the quantizing portion 5 is outputted as a coding result and is also transferred to an inverse quantizing portion 7.

The inverse quantizing portion 7 obtains a DCT coefficient by performing the operations reverse to those made by the quantizing portion 5. The inverse DCT portion 8 performs operations for inverse DCT on the ob-

tained DCT coefficient.

The output signal of the inverse DCT portion 8 is transferred to an adder portion 9 whereby it is added to the predicted value read from the frame memory 2. The sum value is stored in the frame memory portion 2 and will be used for interframe prediction for a proceeding input video-frame. The input video-signal is thus encoded using a loop-like (coding loop) circuit.

Fig. 2 shows a structure of the conventional hierarchical video-coding device which comprises a hierarchy organizing portion 10 for organizing the hierarchy of video-signals, frame memory portions 11 to 17 for storing preceding encoded and decoded video-signals, coding portions 21 to 27 for encoding an input video-signal by referring a preceding coded signal stored in the frame memory portions 11 to 17 and decoding portions 31 to 37 for decoding the coded results outputted from the coding portions 21 to 27.

The operation of the conventional hierarchical video-coding device shown in Fig. 2 is as follows:

The hierarchy organizing portion 10 hierarchically classifies components of an input video-signal. The coding portions 21 to 27 encode corresponding hierarchically classified components of the input video-signal by referring preceding coded and decoded components stored in the frame memory portions 11 to 17 and output the coding results of the hierarchical components to an external device. On the other hand, the coding results from the coding portions 21 to 27 are also transferred to the decoding portions 31 to 37 whereby they are decoded and then transferred to the frame memory portions 11 to 17. The coding results stored in the frame memory portions 11 to 17 will be used for coding a proceeding input video-signal.

As described above, the conventional video-coding device can considerably reduce the information amount of an input video-signal since it quantizes the video-signal after removing its temporal-redundancy by motion-compensated prediction and spatial redundancy by DCT. The coded video-signal with thus reduced information amount, however, is still inadaptable to be transmitted over a communication line featured by a low-transmission rate. Consequently, a sequence of frames to be transmitted is usually thinned by dropping all frames other than selected. This enables increasing the number of bits to be allocated to one frame, thereby improving quality of the coded video-signal.

The above-mentioned conventional video-coding device and video-decoding device, however, can not start decoding a video-frame until coded information of one frame is completely received. Therefore, a considerable delay of transmission may arise with omitting many frames when the devices work on a communication line having a low-transmission rate. The thinned sequence of frames may also decrease temporal-resolution of coded and decoded video-signals.

Referring to accompanying drawings, a video-coding device and a video-decoding device, which are preferred embodiments of the present invention, will be described as follows:

Fig. 3 shows an exemplified structure of a hierarchical coded-information transmitting system used in a video-coding device according to the present invention.

In Fig. 3, the system includes a motion-compensative predicting portion 41 for executing motion-compensated prediction, a subband-decomposition portion 42 for dividing a predicted-error signal into subbands (frequency resolution), coding portions 43 to 49 for encoding predicted error signal of each subband buffer portions 50 to 56, a selecting portion 57, a coded-information transmitting portion 58, a decoding portion 59 and a frame memory portion 60.

The details of the system are as follows:

The motion-compensated predicting portion 41 conducts the motion-compensated prediction of an input video-signal with reference to preceding video-signals just-before encoded, decoded, then stored in the frame memory portion 60. (These reference video-signals will be described later in detail.) The prediction portion 41 outputs an obtained predicted-error signal and motion vectors.

The subband-decomposition portion 42 divides the predicted -error signal received from the motion-compensated predicting portion 41 into subband as shown in Fig. 4. In Fig. 4, an original image is processed horizontally and vertically through one-dimensional frequency band decomposition filter to be divided into 4 subband-division images. Among 4 division images, 1 division image of the lowest frequency components (i. e., a base-band image) is further divided in the same way into 4 subdivision images. All 7 different subband-images are finally prepared.

The coding portions 43 to 49 perform encoding with quantization of respective predicted-error signals received from the subband-decomposition portion 42 to compress the information amount, then output the respective coding results.

The buffer portions 50 to 56 store the coding results received from the coding portions 43 to 49.

The selecting portion 57 determines a hierarchy of transmittable coded information. The transmitting order of the coded images of the subband components is the resolution ascending order, starting the lowest resolution band image (i.e., in the order of images LLLL, LLLH, LLHL, LLHH, LH, HL and HH in Fig. 4). At this time, the coding results corresponding to the subband components are read from the buffers 50 to 56 and outputted to the coded information transmitting portion 58.

The coded information transmitting portion 58 transmits the coded information received from the selecting portion 57 in every hierarchy per frame. At the same time, it transmits motion vectors, a frame start signal, a frame end signal and subband identifiers.

The decoding portion 59 decodes coding results received from the buffers 50 to 56 and outputs the decoding results to the frame memory portion 60.

The frame memory portion 60 stores therein the coded and decoded images (frames) which will be used for interframe prediction coding of a proceeding frame.

The operation of the hierarchical coded-information transmitting means shown in Fig. 3 will be described according to a flow chart of Fig. 5.

The coded-information transmitting portion 58 transmits a frame start signal (Step S1). The motion-compensated predicting portion 41 conducts motion-compensated prediction on an input video-signal and outputs a predicted-error signal and motion vectors (Step S2). The predicted-error signal outputted at Step S2 is divided into subbands by the subband-decomposition portion 42 (Step S3). The coding portions 43 to 49 encode the respective subband-images of the predicted-error signal from Step S3 and stores coding results in the buffer portions 50 to 56 (Step S4). The selecting portion 57 selects the coding result of an image LLLL, reads the coding result from the buffer portion 50 and sends the coding result to the coded-information transmitting portion 58 (Step S5). The coded-information transmitting portion 58 transmits the band identifier of LLLL selected at Step S3 (Step S6) and the coded information obtained at Step S5 (Step S7). On the other hand, the coded information outputted at Step S5 is also transferred to the decoding portion 59 whereby it is decoded (Step S8) and then stored in the frame memory portion 60 (Step S9) for use for motion-compensated predicting of a proceeding frame. The above-mentioned sequential operations from Steps S4 to S9 are repeated for every hierarchy (subbands) in the fore-described (resolution ascending) order (Step 10). After processing all hierarchical subband-components, the coded-information transmitting portion 59 transmits a frame end signal (Step S11) and finishes encoding of one frame. The processing ends when all frames were encoded (Step S12).

Fig. 6 shows an output of a coded-information transmitting portion 58. A frame start signal is first transmitted (61). All motion vectors for one frame are transmitted (62). A subband number identifying a subband whereto a coded information belongs is transmitted (63) and then the coded information of said subband is transmitted (64). The operations 62 and 64 are repeated successively for all subbands ranging from the lowest resolution to the highest resolution. After all were done, a frame end signal is transmitted (65).

Referring to accompanying drawings, a video-decoding device embodying the present invention will be described below:

Fig. 7 shows an exemplified structure of a video-decoding device according to the present invention, which comprises the first selecting portion 71 for determining a decodable hierarchy, decoding portions 72 to 78 for decoding respective hierarchical images, adder portions 79 to 84, the second selecting portion 85 for selecting a decoded image to be displayed, the third selecting portion for controlling images to be stored in a frame memory portion 87, the frame memory portion 87, a motion compensating portion 88 and an adding portion 89.

The details of the components of the video-decoding device are as follows:

The first selecting portion 71 reads a subband number contained in a coded information and transmits coded information to corresponding decoding portion (one of decoding portions 72 to 78 to be described later). The decoding portions 72 to 78 decode the coded information received from the first selecting portion 71 and output a predicted-error signal.

Each of the adder portions 79 to 84 adds a subband predicted error signal to corresponding preceding subband predicted error signal.

The second selecting portion 85 selects one of decoded images outputted from the adder portions 79 to 84, which is to be displayed. This portion works in synchronism with the first selecting portion 71.

The third selecting portion 86 works in synchronism with the first selecting portion 71. When all subbands have been decoded, the third selecting portion 86 stores decoded images into the frame memory portion 87.

The frame memory portion 87 stores a preceding decoded image. The motion-compensating portion 88 performs motion-compensative prediction operations by using motion vectors and the preceding decoded image stored in the frame memory portion 87. At the same time, it conducts scaling of motion vectors in proportion to time of a subband-image to be decoded.

The adder portion 89 synthesizes a decoded image by adding a predicted-error signal to a predicted-value received from the frame memory portion 87.

The operation of the video-decoding device shown in Fig. 7 will be described according to a flow chart of Fig. 8 and scaling of motion vector shown in Fig. 9. It is assumed that an input coded video-information is formatted as shown in Fig. 6. A frame start signal is first detected (Step T1), then succeeding information "motion vector" (62) is transferred to the motion compensating portion 88 (Step T2). The first selecting portion 71 judges that a succeeding information "band number" (63) indicates the lowest band LLLL and transfers a succeeding information "coded information" (64) to the decoding portion 72 for decoding the coded information of the LLLL-band (Step T3). The decoding portion 72 decodes the coded information (64) received at Step T3 and outputs a predicted-error signal of the LLLL-band component to the second selecting portion 85 and the adder portion 89 (Step T4). On the other hand, the second 85 works in synchronism with the first selecting portion 71 and outputs the decoded predicted-error signal of the received LLLL-band of the coded information to the adder portion 89 (Step T5). On the other hands, the motion compensating portion 88 conducts motion compensating prediction by scaling the motion vectors received at Step T2 and reads a predicted value from the frame memory portion 87 (Step T6). The predicted-error

signal outputted at Step T5 and the predicted value outputted at Step T6 are added to each other by the adder portion 89, then a decoded image is outputted (Step T7). Decoding the lowest band image LLLL is now finished. Next, the first selecting portion (63) judges that a succeeding information "band number" 73 indicates a band LLLH to be decoded and transfers a succeeding information "coded information" (64) to the decoding portion (63) for decoding the coded information of the LLLH-band (Step T8). The decoding portion 73 decodes the coded information (64) received at Step T8 and outputs a predicted-error signal of LLLH-band to the adder portion 79 (Step T9). The adder portion 79 adds the LLLL-band predicted-error signal obtained at Step T5 to the LLLH-band predicted-error signal obtained at Step T9 and sends the calculation result to the second selecting portion 85 and the adder potion 80 (Step T10). The second selecting portion 85, which works in synchronism with the first selecting portion 71, outputs the predicted-error signal obtained by adding the LLLL-band value to the LLLH-band value at Step T10 to the adder portion 89 (Step T11). On the other hands, the motion compensating portion 88 conducts motion compensating prediction by scaling the motion vectors received at Step T2 and reads a predicted value from the frame memory portion 87 (Step T12). The predicted-error signal outputted at Step T11 and the predicted value outputted at Step T12 are added to each other by the adder portion 89, then a decoded image is outputted (Step T13). Decoding the band images LLLL and LLLH is now finished. The same operations as Steps T8 to T13 are repeated for each of subband images LLHL, LLHH, LH, HL and HH in the shown order (Step 14). On the completion of decoding all subbands, the third selecting portion 86, which works in synchronism with the first selecting portion 71, outputs and stores the decoded image (video-frame) into the frame memory portion 87 (Step T15). The processing ends after completing the decoding of all frames (Step T16).

Fig. 10 shows the state of decoded images (video-frames) when decoding received coded information formatted as shown in Fig. 6 by the video-decoding device according to the present invention as compared with the state of decoded images when decoding the same coded information by the prior art decoding device. As shown in Fig. 10, the video-decoding device according to the present invention can decode an image of a lowest resolution band LLLL at the beginning stage of receiving a video-signal and, then, sequentially synthesize images for every hierarchical layer on completion of receiving and decoding each layer image. Owing to this advantageous feature, the transmission delay may be limited to a time necessary for receiving coded information of a lowest resolution band LLLL, assuring a considerable reduction of the transmission delay time. An output image of each stage is obtained by stepwise increasing a predicted value by each of subband components (from low frequency to high frequency) of predicted-error signal and, therefore, can be used as frames for interpolating dropped frames. The first received motion vector can be scaled to adapt to respective timing of receiving and decoding coded information of subsequently receivable subbands. This enables forming interpolating frames representing smooth motion, assuring considerable improvement of temporal resolution and quality of output images. This can be achieved without any special interpolating processing. By this reason, the video-decoding device can be made more compact as compared with the conventional device.

As is apparent from the foregoing description, the present invention offers the following advantageous effects:

As coded information of every subband for one video-frame is successively transmitted in an ascending order of resolution from a low frequency and decoded by the video-decoding device according to the present invention, the need for waiting for arriving entire information of coded object image is eliminated even in video-transmission over a low bit-rate communication line. This realizes a considerable reduction of a transmission delay.

An output image of each stage is obtained by stepwise increasing a predicted value by each of band components (from low frequency to high frequency) of predicted-error signal and, therefore, can be used as frames for interpolating dropped frames.

The first received motion vector can be scaled to adapt to respective timing of receiving and decoding coded information of subsequently receivable subbands, enabling forming interpolating frames representing smooth motion, assuring considerable improvement of temporal resolution and quality of output images. No special interpolating processing is required and, therefore, the decoding device can be made more compact as compared with the conventional device.

Claims

1. A video coding device which comprises band-dividing means (42) for dividing a video-frame into bands and hierarchical information-transmitting means (43 to 49, 57) for separately encoding video-information of each band division received from the band dividing means (42) and successively transmitting the coded video-information of at every resolution in each frame.

2. A video decoding device for decoding and displaying receiving coded video-information of band divisions for respective resolution ranges, which has hierarchical video-decoding means (72 to 78) that decode coded video-information of band-divisions for every resolution in the order from low to high resolution and displays the decoded video-information, then adds a sequence of transmitted images of

high-resolution components to the corresponding images of low-resolution and displays complete video-frames.

3. A video coding device according to claim 1, wherein said band-dividing means (42) is arranged to receive a predicted-error signal representing the video-frame and wherein said hierarchical information-transmitting means (43 to 49, 57) is arranged to successively transmit the coded video-information for each frame in order of increasing resolution.

4. A video coding device according to claim 3, further including decoding means (59) coupled to receive the separately encoded video-information of each band division and arranged to decode said encoded video-information and to store the decoded video-information in a memory (60) for use in motion-compensated predicting of a following frame.

5. A video communication system which can use a transmission channel having a low transmission rate and having a video coding device at the transmitter and a video decoding device at the receiver, and in which hierarchical components of a predicted error signal are derived, encoded and sequentially transmitted in order of increasing resolution so that image decoding can commence at the receiver before a complete high resolution image frame is stored there.

FIG.1
(PRIOR ART)

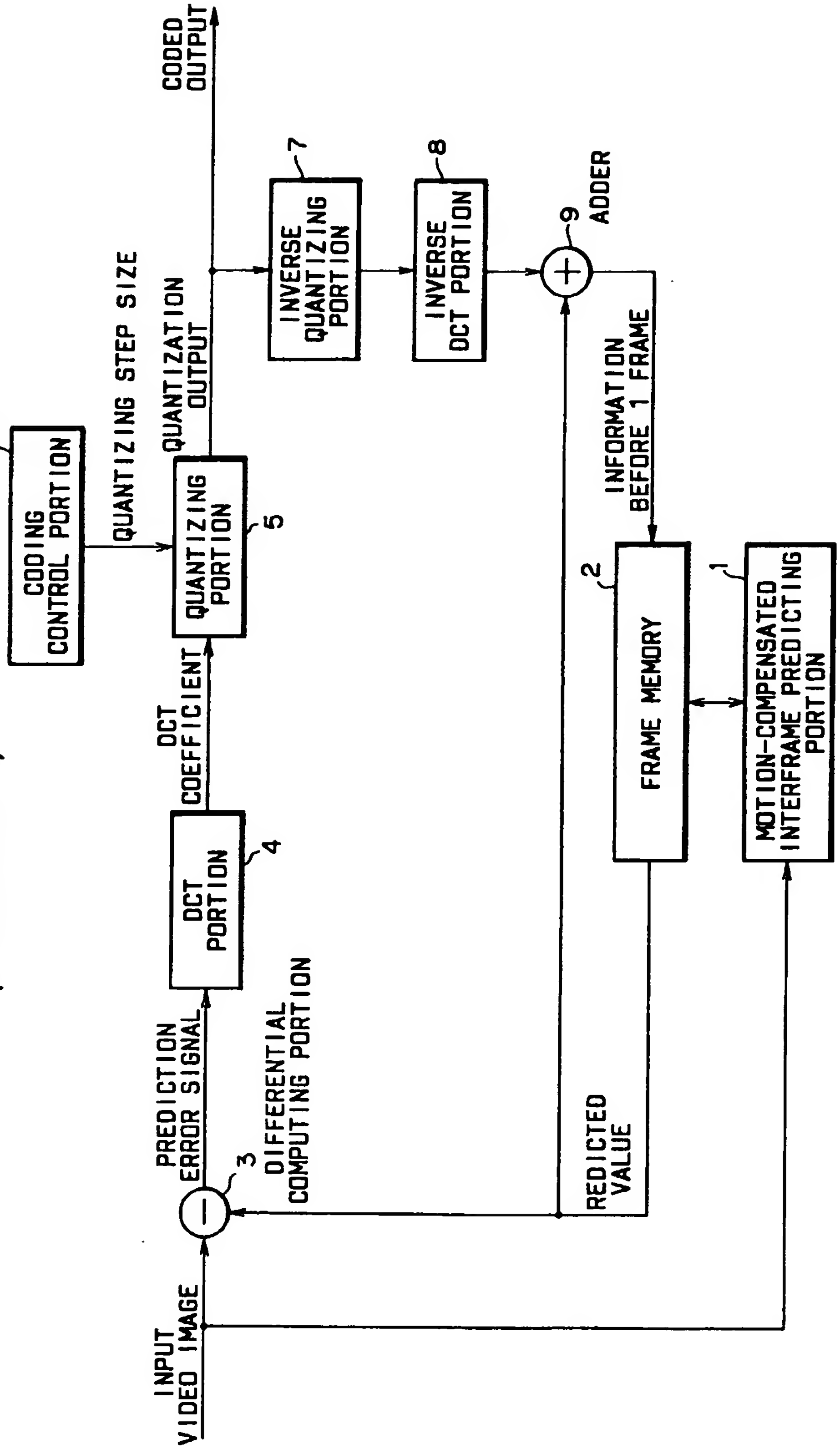


FIG.2
(PRIOR ART)

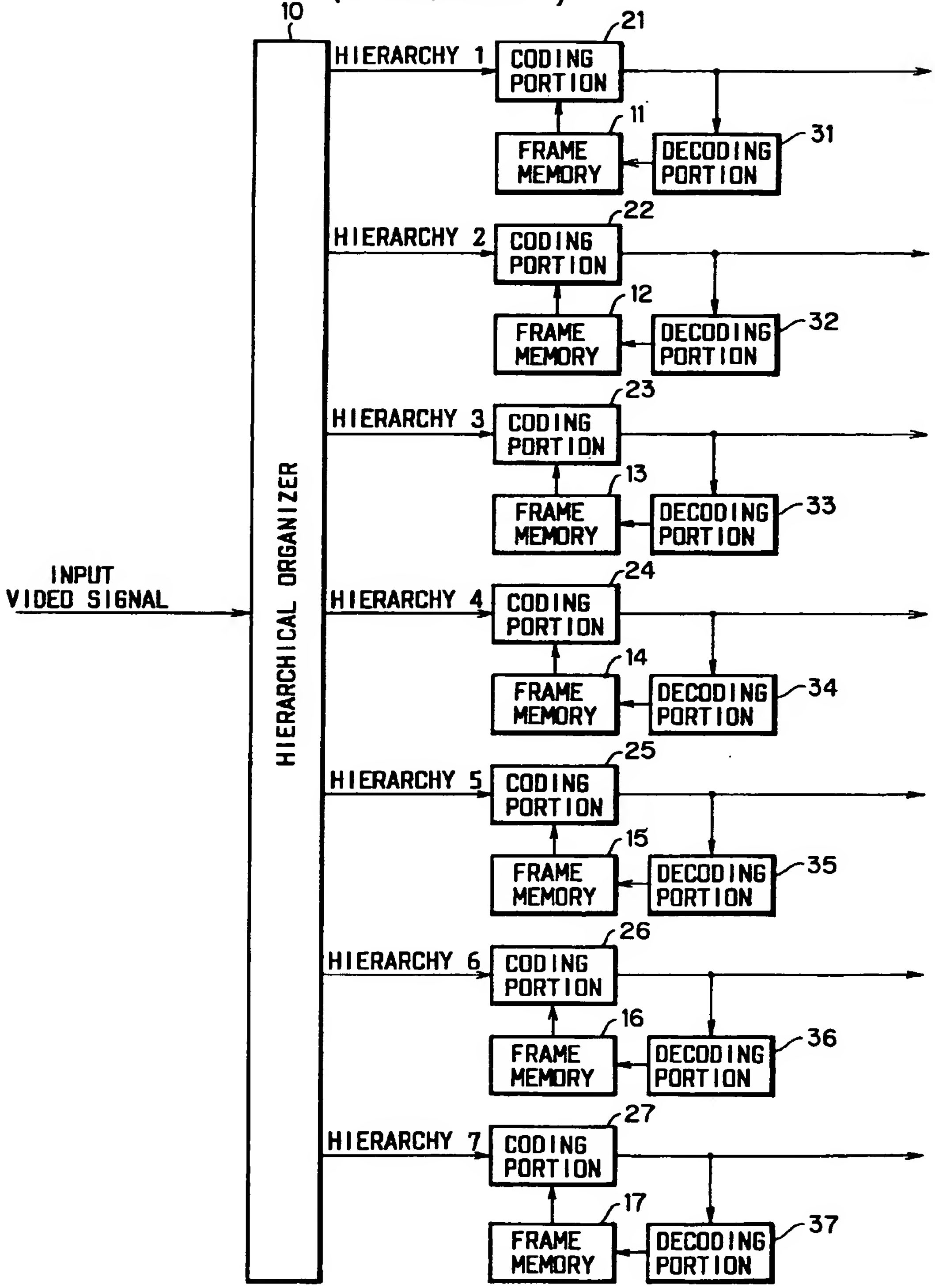
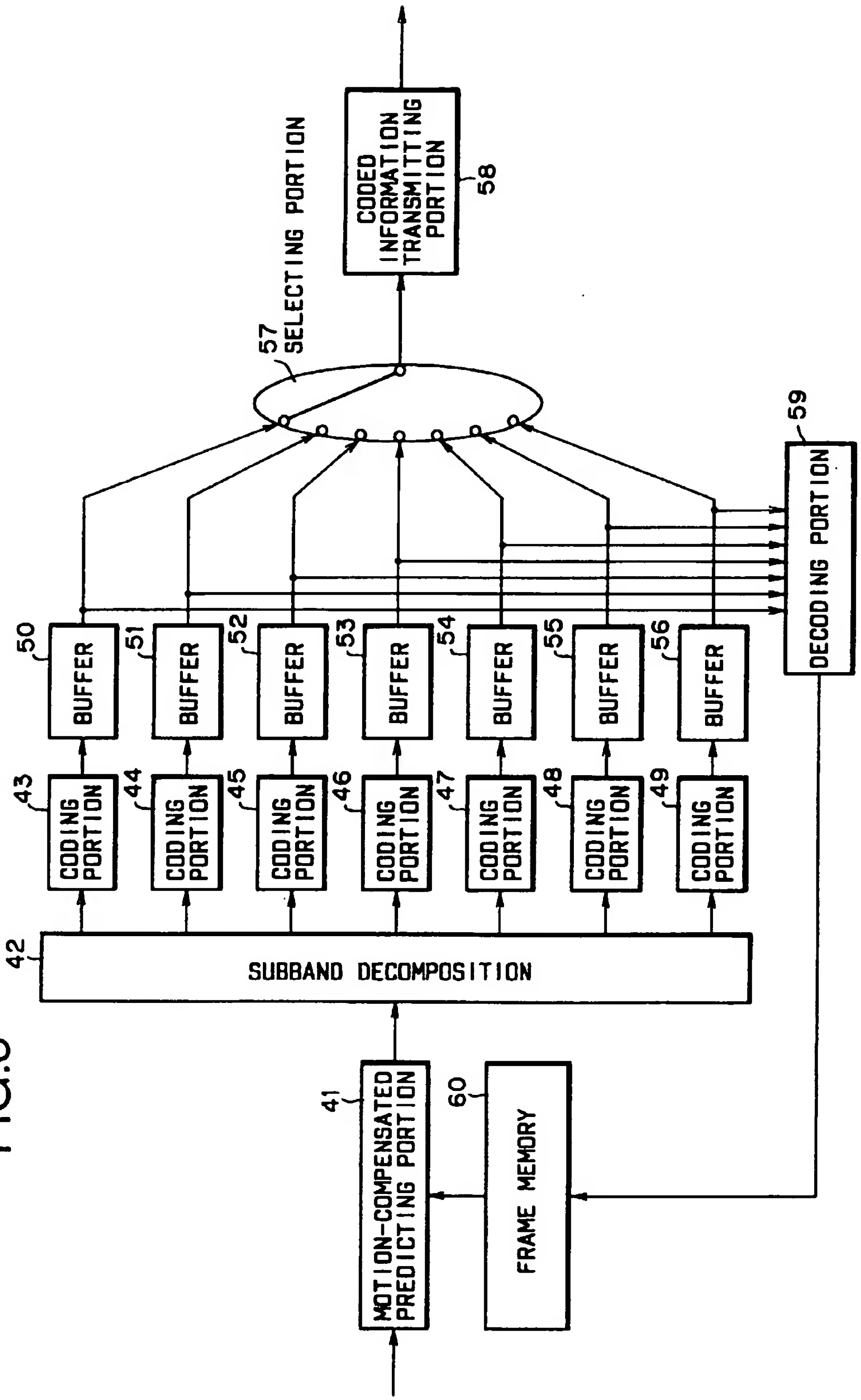


FIG.3



MOTION-COMPENSATED PREDICTING PORTION
41
FRAME MEMORY
60
SUBBAND DECOMPOSITION
42
CODING PORTION
43
44
45
46
47
48
49
BUFFER
50
51
52
53
54
55
56
57
SELECTING PORTION
CODED INFORMATION TRANSMITTING PORTION
58
DECODING PORTION
59

FIG.4

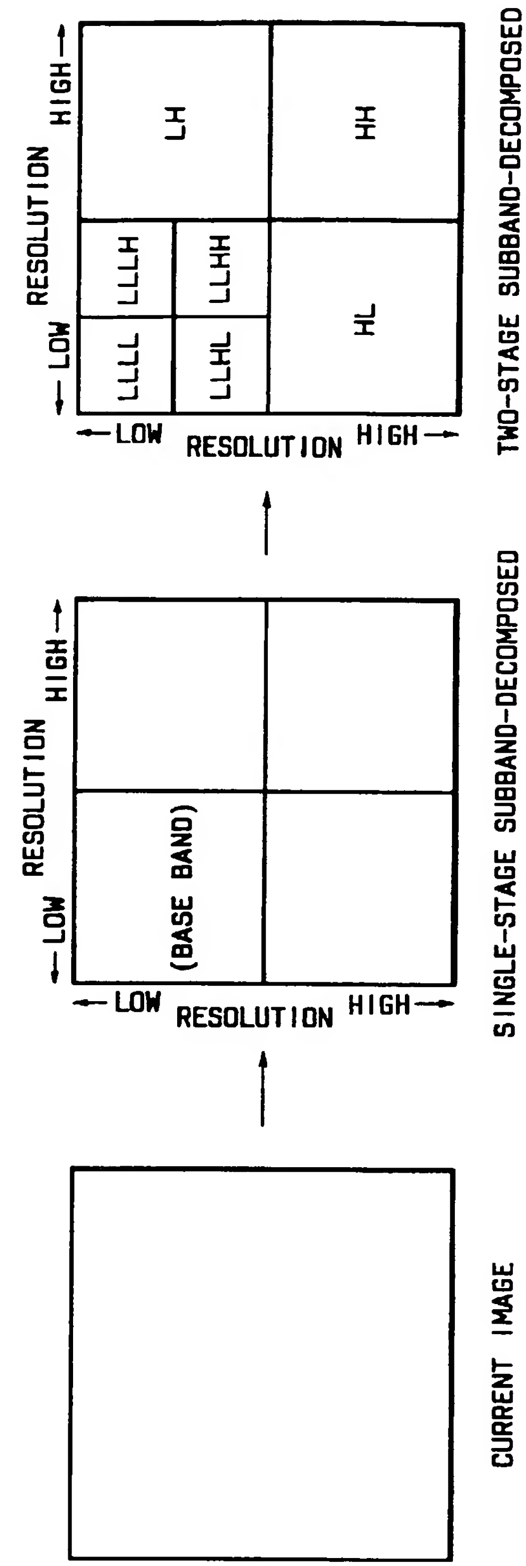

LOW
RESOLUTION
HIGH
LLLL
LLLH
LLHL
LLHH
LH
HL
HH
TWO-STAGE SUBBAND-DECOMPOSED
(BASE BAND)
SINGLE-STAGE SUBBAND-DECOMPOSED
CURRENT IMAGE

FIG.5

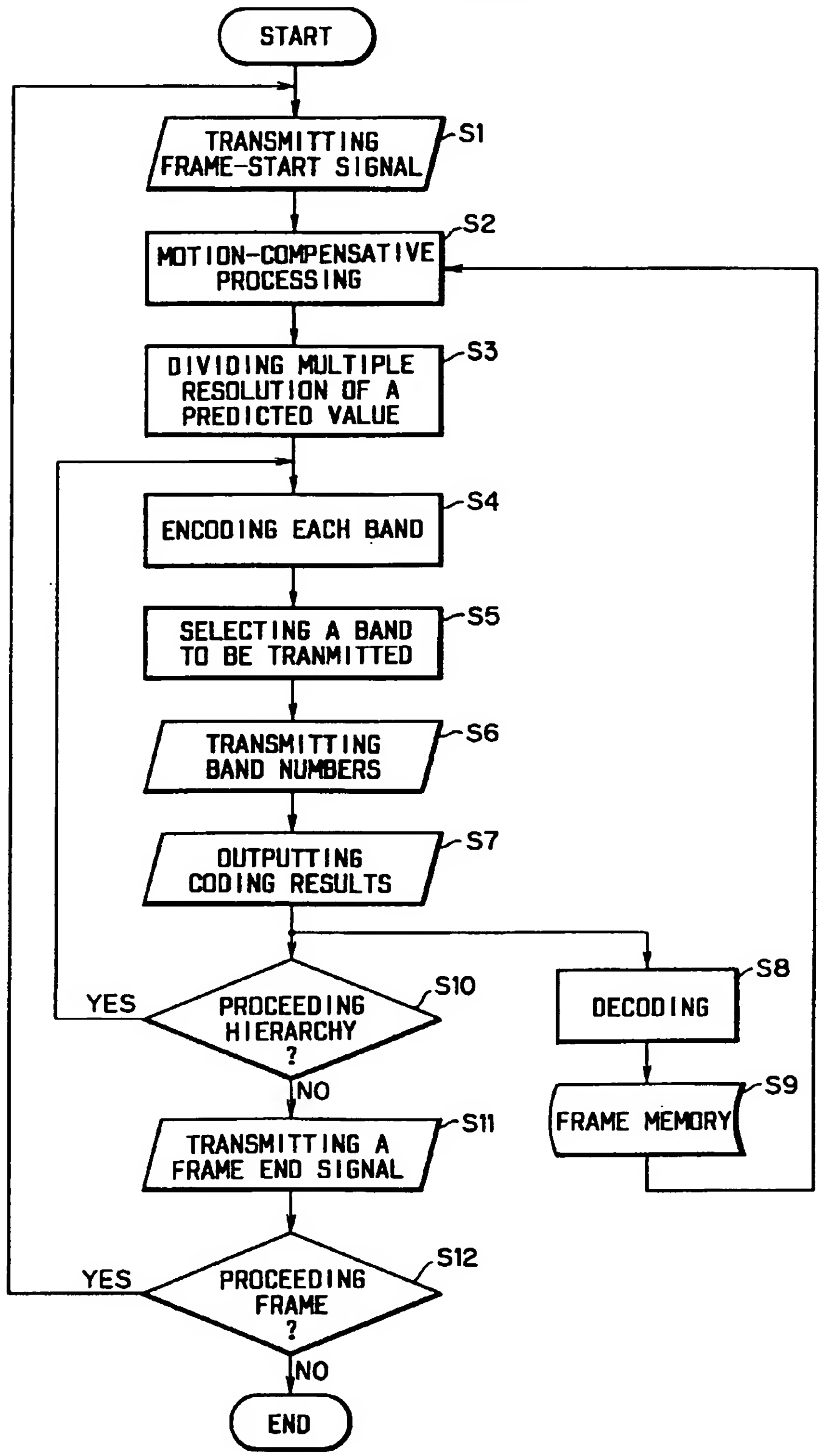

START
TRANSMITTING FRAME-START SIGNAL
S1
MOTION-COMPENSATIVE PROCESSING
S2
DIVIDING MULTIPLE RESOLUTION OF A PREDICTED VALUE
S3
ENCODING EACH BAND
S4
SELECTING A BAND TO BE TRANMITTED
S5
TRANSMITTING BAND NUMBERS
S6
OUTPUTTING CODING RESULTS
S7
DECODING
S8
FRAME MEMORY
S9
PROCEEDING HIERARCHY ?
S10
YES
NO
TRANSMITTING A FRAME END SIGNAL
S11
PROCEEDING FRAME ?
S12
YES
NO
END

FIG.6

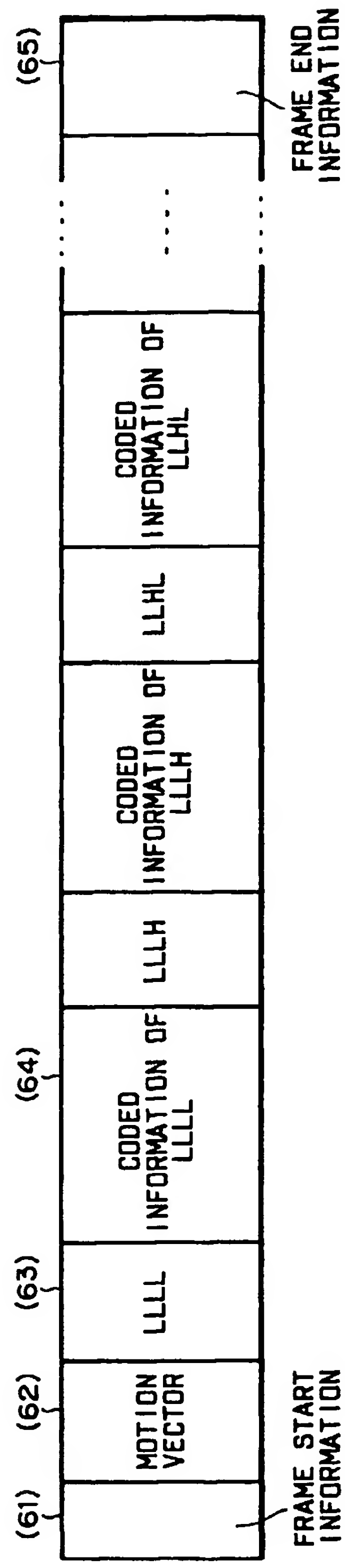
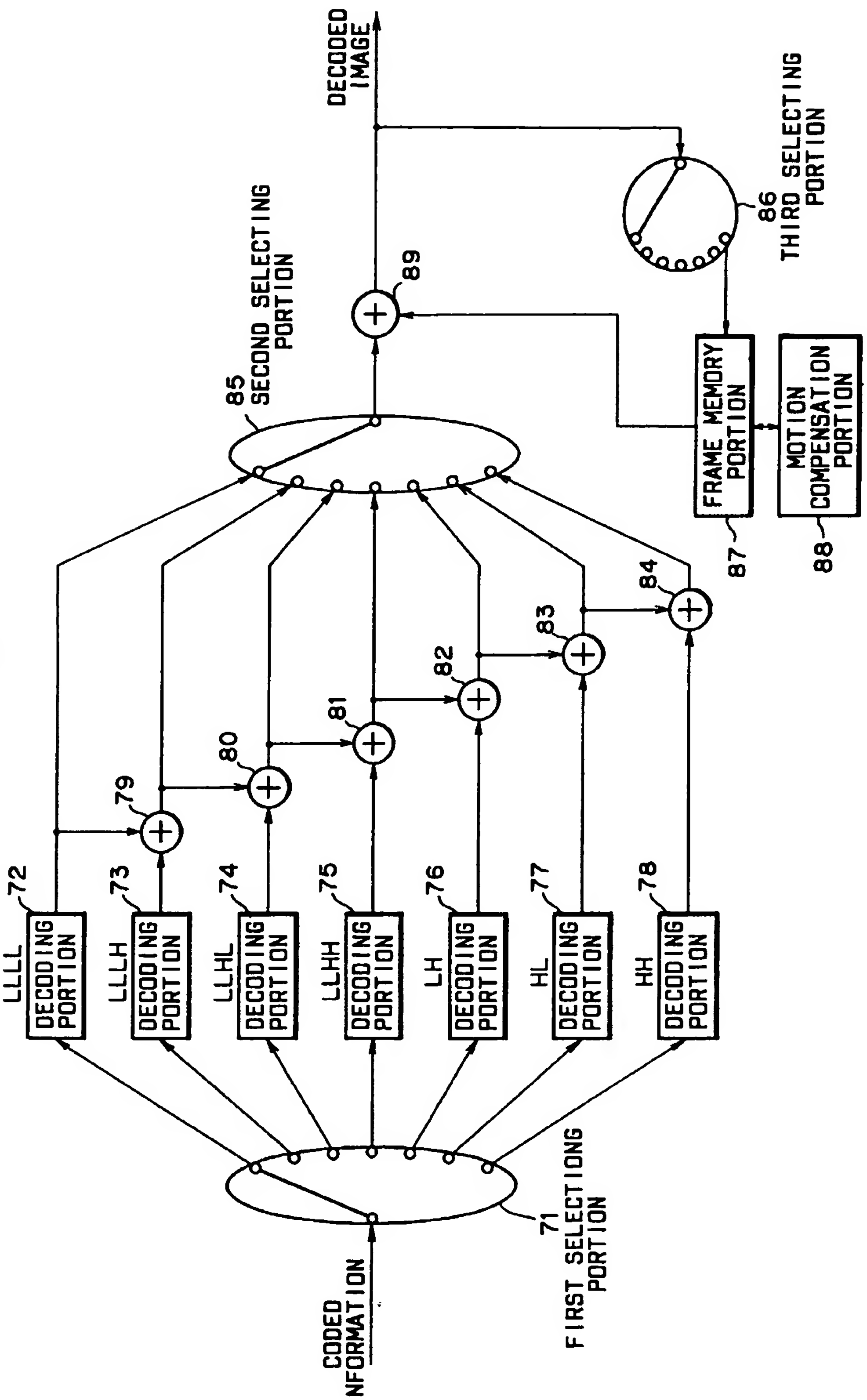

(61)
FRAME START INFORMATION
(62)
MOTION VECTOR
(63)
LLLL
(64)
CODED INFORMATION OF LLLL
LLLH
CODED INFORMATION OF LLLH
LLHL
CODED INFORMATION OF LLHL
(65)
FRAME END INFORMATION

FIG.7



CODED INFORMATION
71 FIRST SELECTIONG PORTION
LLLL DECODING PORTION 72
LLLH DECODING PORTION 73
LLHL DECODING PORTION 74
LLHH DECODING PORTION 75
LH DECODING PORTION 76
HL DECODING PORTION 77
HH DECODING PORTION 78
79
80
81
82
83
84
85 SECOND SELECTING PORTION
89
DECODED IMAGE
86 THIRD SELECTING PORTION
87 FRAME MEMORY PORTION
88 MOTION COMPENSATION PORTION

FIG.8

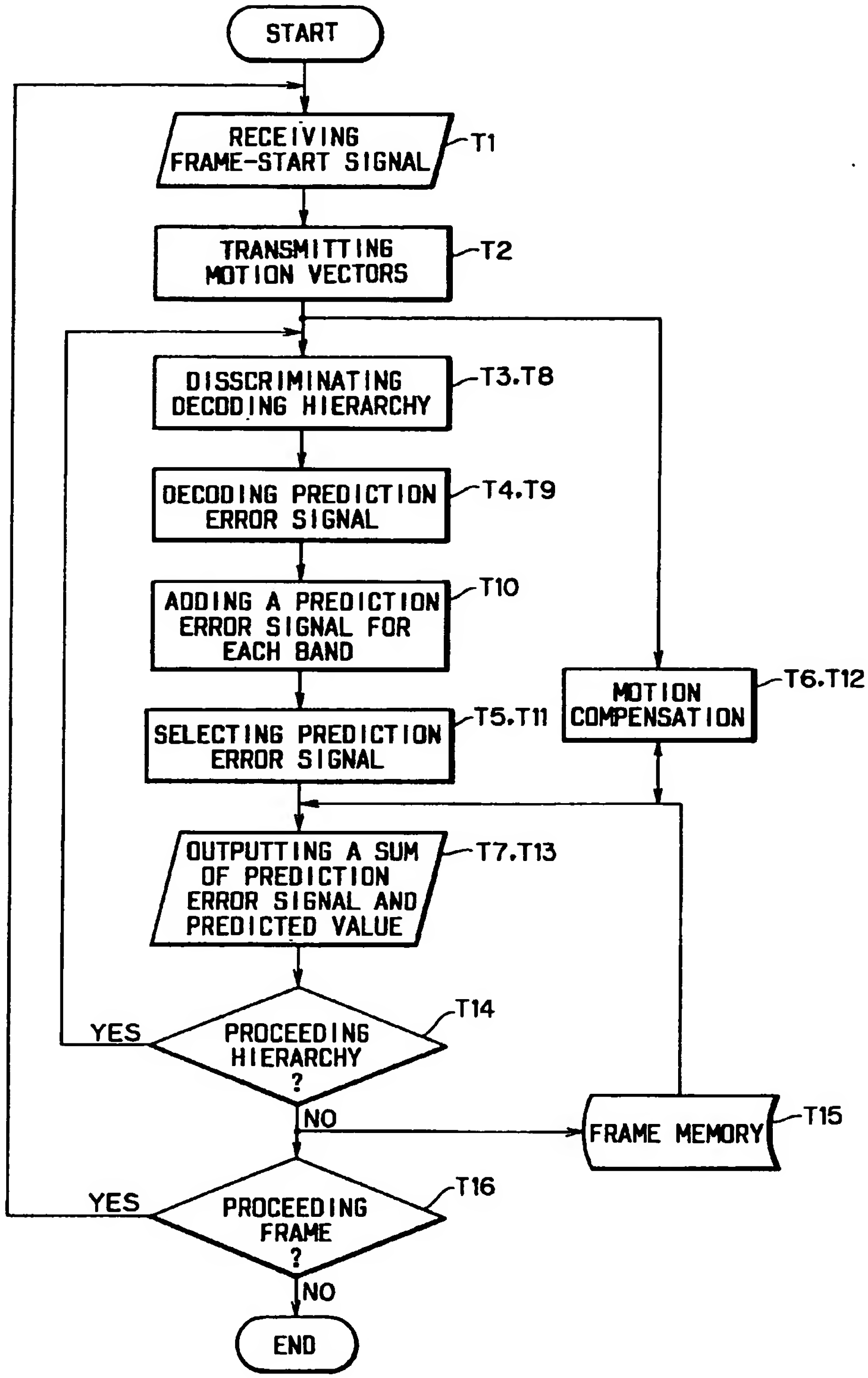

START
RECEIVING FRAME-START SIGNAL
T1
TRANSMITTING MOTION VECTORS
T2
DISSCRIMINATING DECODING HIERARCHY
T3.T8
DECODING PREDICTION ERROR SIGNAL
T4.T9
ADDING A PREDICTION ERROR SIGNAL FOR EACH BAND
T10
MOTION COMPENSATION
T6.T12
SELECTING PREDICTION ERROR SIGNAL
T5.T11
OUTPUTTING A SUM OF PREDICTION ERROR SIGNAL AND PREDICTED VALUE
T7.T13
YES
PROCEEDING HIERARCHY ?
T14
NO
FRAME MEMORY
T15
YES
PROCEEDING FRAME ?
T16
NO
END

FIG.9

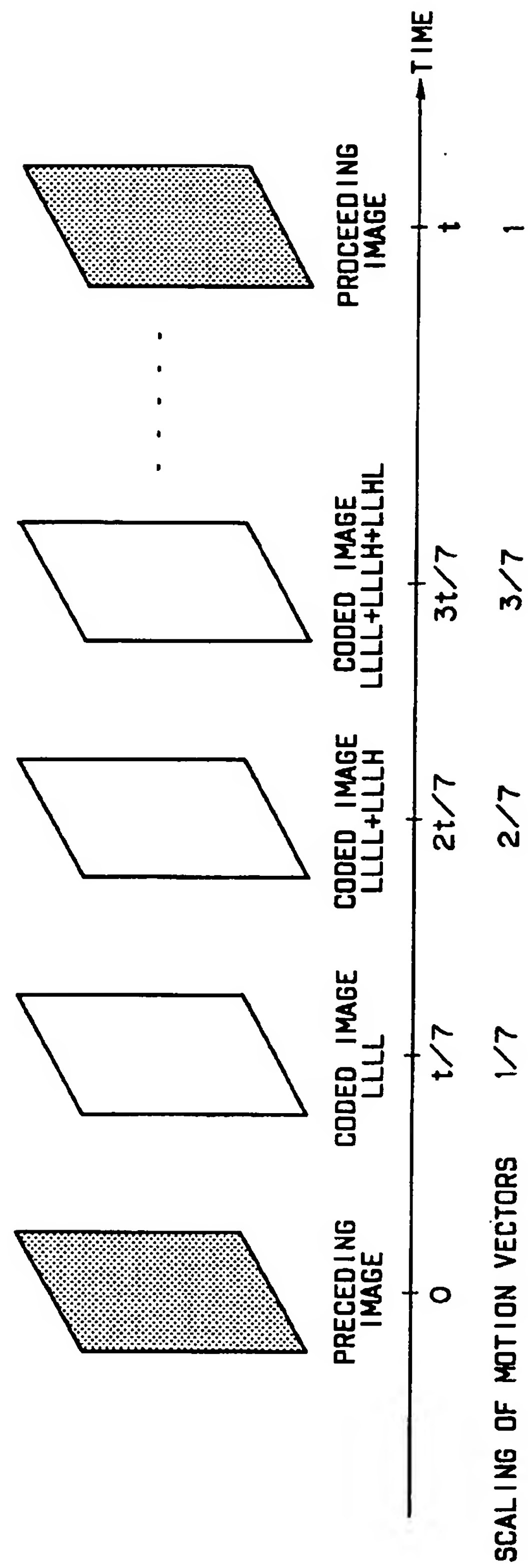
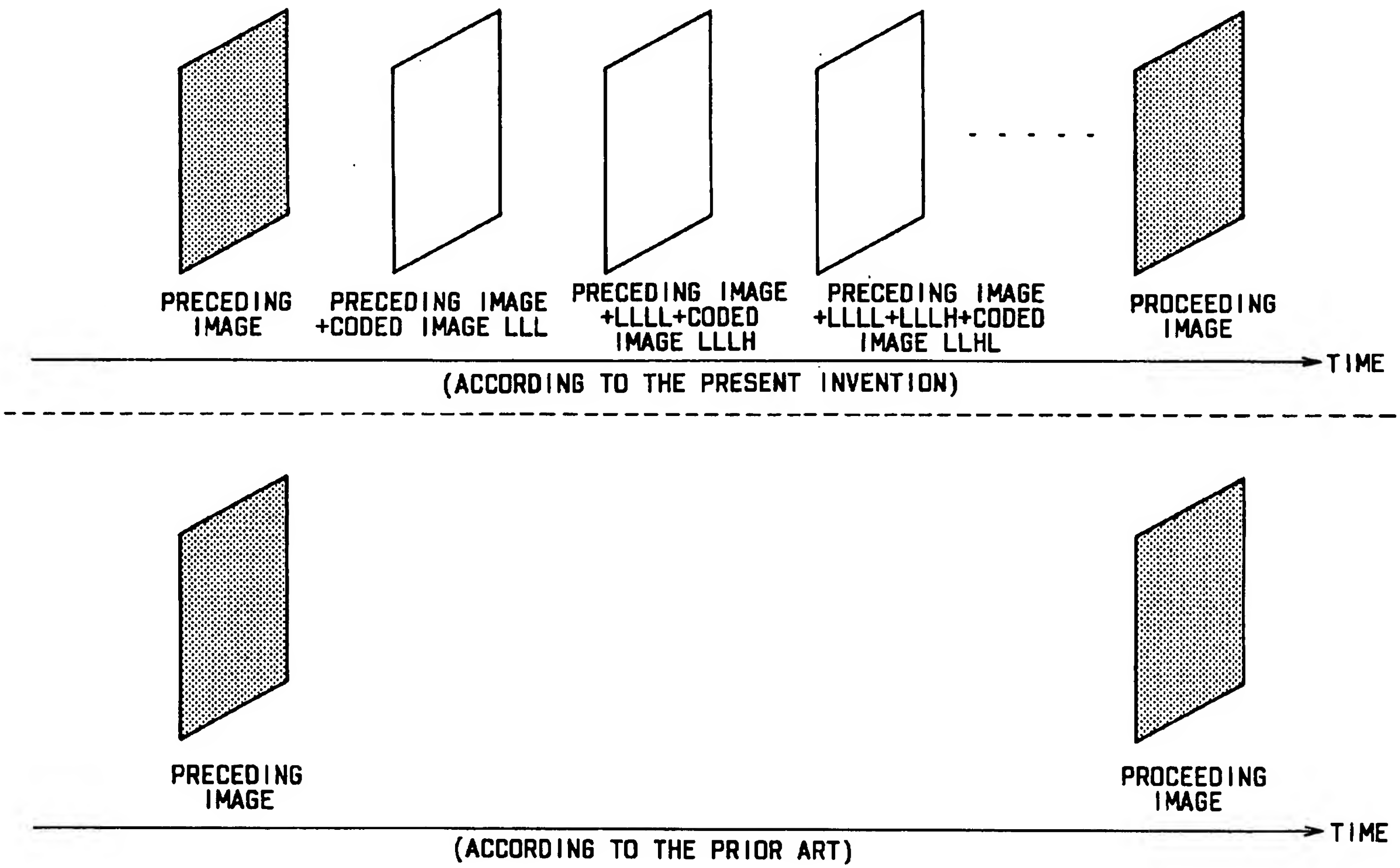

PRECEDING IMAGE
CODED IMAGE LLLL
CODED IMAGE LLLL+LLLH
CODED IMAGE LLLL+LLLH+LLHL
PROCEEDING IMAGE
TIME
0
t/7
2t/7
3t/7
t
SCALING OF MOTION VECTORS
1/7
2/7
3/7
1

FIG.10


PRECEDING IMAGE
PRECEDING IMAGE +CODED IMAGE LLL
PRECEDING IMAGE +LLLL+CODED IMAGE LLLH
PRECEDING IMAGE +LLLL+LLLH+CODED IMAGE LLHL
PROCEEDING IMAGE
TIME
(ACCORDING TO THE PRESENT INVENTION)
PRECEDING IMAGE
PROCEEDING IMAGE
TIME
(ACCORDING TO THE PRIOR ART)